

WHAT IS CLAIMED IS:

1. An image processing method for detecting a direction of an image including a character area, inputted into a computer, said method comprising:
 - a binary image generation step of generating a binary image of said image;
 - a tile image generation step of generating a tile image by applying a predetermined value to tiles, each corresponding to a predetermined size area in said binary image;
 - a character area extraction step of extracting an area in said binary image, corresponding to an area in a circumscribed rectangle surrounding connected pixels having the same value in said tile image, as a character area; and
 - a direction detection step of recognizing a direction of characters included in said character area and thereby detecting the direction of said image.
2. The image processing method according to claim 1, wherein at said binary image generation step, the binary image is generated with image area flags having a value 1 corresponding to a pixel equal to or greater than a predetermined value or a value 0 corresponding to a pixel less than the predetermined value, and at said tile image generation step, the tile

image is generated with a tile having a value 1 where
the number of image area flags having the value 1 is
equal to or greater than a predetermined threshold
value, and a tile having a value 0 where the number of
5 image area flags having the value 1 is less than the
predetermined threshold value.

3. The image processing method according to claim 1,
further comprising: a character extraction step of
10 extracting the respective characters included in said
character area extracted at said character area
extraction step; and

a character recognition step of recognizing a
direction of said characters extracted at said
15 character extraction step,

wherein at said direction detection step, the
direction of said character area is detected based on
the result of recognition of the direction of said
characters included in said character area.

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4. The image processing method according to claim 1,
further comprising:

a determination step of determining whether or
not said character area is an inverted image based on
25 the binary image of said image; and

an inversion processing step of inverting black
and white components of said binary image if it is

determined at said determination step that said character area is an inverted image.

5. The image processing method according to claim 2,
5 wherein at said tile image generation step, plural tile images are generated using plural different threshold values,

and wherein at said character area extraction step, the plural tile images are compared with each
10 other and the character area included in said image is extracted.

6. The image processing method according to claim 1,
wherein said tile image is a low resolution binary
15 image generated by counting said binary image, generated by differentiating said image, by a small area.

7. The image processing method according to claim 1,
20 wherein said tile image is a low resolution differential image generated by counting differential information of said image by a small area.

8. The image processing method according to claim 6,
25 wherein at said character area detection step, an area in said image, corresponding to the connected pixels extracted from said low resolution image, is extracted

as a character area.

9. The image processing method according to claim 6,
wherein at said tile image generation step, plural low
5 resolution images are generated using plural different
threshold values.

10. The image processing method according to claim 9,
wherein at said character area extraction step,
10 connected pixels extracted from said plural low
resolution images are compared with said plural low
resolution images and said character area is extracted.

11. The image processing method according to claim 6,
15 wherein at said character area extraction step, said
low resolution image is divided into meshes, and said
character area is extracted based on distribution of
pixels within each mesh area.

20 12. The image processing method according to claim 11,
wherein said character area extraction step includes a
selection output step of selectively outputting a
character area extracted using connected pixels
extracted from said low resolution image and a
25 character area determined based on the distribution of
pixels within each mesh area.

13. An image processing apparatus comprising:

input means for inputting an image including a character area;

binary image generation means for generating a
5 binary image of said image;

tile image generation means for generating a tile image by applying a predetermined value to tiles, each corresponding to a predetermined size area in said binary image;

10 character area extraction means for extracting an area in said binary image, corresponding to an area in a circumscribed rectangle surrounding connected pixels having the same value in said tile image, as a character area; and

15 direction detection means for recognizing a direction of characters included in said character area and thereby detecting the direction of said image.

14. The image processing apparatus according to claim
20 13, wherein said binary image generation means generates the binary image with image area flags having a value 1 corresponding to a pixel equal to or greater than a predetermined value or a value 0 corresponding to a pixel less than the predetermined value,
25 and said tile image generation means generates the tile image with a tile having a value 1 where the number of image area flags having the value 1 is equal

to or greater than a predetermined threshold value, and a tile having a value 0 where the number of image area flags having the value 1 is less than the predetermined threshold value.

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15. The image processing apparatus according to claim 13, further comprising character extraction means for extracting the respective characters included in said character area extracted by said character area

10 extraction means,

wherein said direction detection means recognizes a direction of the respective characters, and detects the direction of said character area based on the result of recognition.

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16. The image processing apparatus according to claim 13, further comprising:

determination means for determining whether or not said character area is an inverted image based on the binary image of said image; and

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inversion processing means for inverting black and white components of said binary image if said determination means determines that said character area is an inverted image.

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17. The image processing apparatus according to claim 13, wherein said tile image generation means generates

plural tile images using plural different threshold values,

and wherein said character area extraction means extracts the character area included in said image
5 using the plural tile images.

18. The image processing apparatus according to claim 13, wherein said character area extraction means divides said tile image into meshes, and extracts said
10 character area based on distribution of pixels within each mesh area.

19. The image processing apparatus according to claim 18, wherein said character area extraction means
15 includes selection output means for selectively outputting a character area extracted using connected pixels extracted from said tile image and a character area determined based on the distribution of pixels within each mesh area.

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20. A program for a computer to execute:

a binary image generation procedure of generating a binary image of an image including a character area;

a tile image generation procedure of generating a
25 tile image by applying a predetermined value to tiles, each corresponding to a predetermined size area in said binary image;

a character area extraction procedure of
extracting an area in said binary image, corresponding
to an area in a circumscribed rectangle surrounding
connected pixels having the same value in said tile
5 image, as a character area; and

a direction detection procedure of recognizing a
direction of characters included in said character area
and thereby detecting the direction of said image.

10 21. The program according to claim 20, wherein at said
binary image generation procedure, the binary image is
generated with image area flags having a value 1
corresponding to a pixel equal to or greater than a
predetermined value or a value 0 corresponding to a
15 pixel less than the predetermined value,

and at said tile image generation procedure, the
tile image is generated with a tile having a value 1
where the number of image area flags having the value 1
is equal to or greater than a predetermined threshold
20 value, and a tile having a value 0 where the number of
image area flags having the value 1 is less than the
predetermined threshold value.

22. The program according to claim 20, further to
25 execute a character extraction procedure of extracting
the respective characters included in said character
area extracted at said character area extraction

procedure,

wherein at said direction detection procedure, a direction of the respective characters is recognized, and the direction of said character area is detected
5 based on the result of recognition.

23. The program according to claim 20, further to execute:

a determination procedure of determining whether
10 or not said character area is an inverted image based on the binary image of said image; and

an inversion processing procedure of inverting black and white components of said binary image if it is determined at said determination procedure that said
15 character area is an inverted image.

24. The program according to claim 20, wherein at said tile image generation procedure, plural tile images are generated using plural different threshold values,
20 and wherein at said character area extraction procedure, the plural tile images are compared with each other and the character area included in said image is extracted.

25 25. The program according to claim 20, wherein at said character area extraction procedure, said tile image is divided into meshes, and said character area is

extracted based on distribution of pixels within each mesh area.

26. The program according to claim 25, wherein said
5 character area extraction procedure includes a
selection output procedure of selectively outputting a
character area extracted using connected pixels
extracted from said low resolution image and a
character area determined based on the distribution of
10 pixels within each mesh area.

27. A computer-readable storage medium holding the
program according to claim 20.

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